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EXAMINER

UMEZ ERONINI, LYNETTE T

ART UNIT	PAPER NUMBER
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1765

DATE MAILED: 08/24/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

09/870,534

Applicant(s)

SRIVASTAVA ET AL.

Examiner

Lynette T. Umez-Eronini

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 5/23/06.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-12, 14 and 15 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-12, 14, and 15 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
- ☐ Certified copies of the priority documents have been received.
 - ☐ Certified copies of the priority documents have been received in Application No. _____.
 - ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|---|---|
| 1) <input type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413) |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | Paper No(s)/Mail Date. _____ |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

Claim Rejections - 35 USC § 103

1. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

2. This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

3. Claims 1, 4, 5, and 6 are rejected under 35 U.S.C. 103(a) as being unpatentable over Erk (US 5,340,437) in view of Datta et al. (US 5,462,638).

As pertaining to claims 1, 4, and 5, Erk teaches a method comprising the steps of:

immersing an article into a tank of etchant (column 7, lines 13-17).

Erk also teaches, " . . . the wafers are etched . . . for a period of about 1 to 10 minutes . . . wafers are rotated while they are in contact with the flowing etchant . . . the

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wafers are rotated at a speed less than about 5 rpm" (column 4, lines 19-26). "As the etchant flows into the etch tank, . . . the drive mechanism . . . are rotated to cause the semiconductor wafers rotate . . ." (column 7, lines 17-24 and column 8, lines 30-32), which reads on rotating the article while in the etchant for an amount of time so as to cause improved uniformity of etching of the film across the entire article compared to etching without rotating the article; and

removing the article from the tank of etchant (column 8, lines 38-42).

Erk differs in failing to teach the article contains a film having a plurality of solder bump on an article and immersing the solder bumps into a tank of etchant, **in claim 1** and the film is a metallic film, **in claim 6**.

Datta teaches, "After the solder bumps are formed, . . . The substrate now is covered with . . . solder bumps" (column 3, lines 10-12). "The etchant removes Ti-W . . ." It can be used with dip etching" (column 7, lines 41-44). The former reads on the article contains a film having a plurality of solder bump on an article and the latter reads on immersing the article containing the film having a plurality of solder bumps into a tank of etchant, as in claim 1 and the above further reads on the film is a metallic film, as in claim 6. Datta illustrates that wafers with solder bumps are conventionally etched by dip etching.

It would have been obvious to one having ordinary skill in the art at the time of the claimed invention to employ any wafer, including a conventional wafer having solder bumps as disclosed by Datta in the process of Erk because Erk does not limit the specific types of wafers processed by the rotating etching process. It would appear that

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any wafer, including one with solder bumps, would benefit from the uniform etching process of Erk. Applicants have not shown anything unexpected by employing a conventional wafer with solder bumps in a known process for achieving uniform etching.

4. Claims 2 and 3 are rejected under 35 U.S.C. 103(a) as being unpatentable over Erk (US '437) in view of Datta (US '628) as applied to claim 1 above, and further in view of Takeshi et al. (English Abstract of JP 9115977 A2).

Erk in view of Datta differs in failing to teach the step of rotating comprises sequentially rotating the article, **in claims 2 and 3**; and

sequentially rotating comprises rotating the article an amount but less than a complete rotating and repeating the steps of rotating and etching for an amount of time, **in claim 3**.

It is well known in the art that a complete rotation is 360 degrees. Takeshi teaches the steps of setting a fixed angular velocity so that the total angle of rotation becomes less than 360 degrees [0025 and 0028], which reads on rotating the article a predetermined amount but less than a complete rotation. Takeshi also teaches repeating the step of rotating and etching for an amount of time [0030], further reads on sequentially rotating comprises rotating the article an amount but less than a complete rotating.

It would have been obvious to modify Erk in view of Datta by using Takeshi's step of sequentially rotating an article for an amount but less than a complete rotation,

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and repeating the steps of rotating and etching for an amount of time for the purpose of improving the method of detecting defects in semiconductor processing.

5. Claim 7 is rejected under 35 U.S.C. 103(a) as being unpatentable over Erk (US 437) in view of Datta (US '638) as applied to claim 1 above, and further in view of Barbee (US '705).

Erk in view of Datta differs in failing to teach the film is a non-metallic film.

Barbee teaches a workpiece **20**, such as a semiconductor wafer comprises one or more film layers on a surface thereof, the film layers are either patterned or unpatterned (column 5, lines 42-50; column 7, lines 67 - column 8, line 7) and “ . . . the removal of a conducting or dielectric film from the etched work piece **20** . . . ” (column 6, lines 63-64), which reads on the article containing a film being non-metallic.

Hence, it would have been obvious to one having ordinary skill in the art at the time of the claimed invention to modify Erk in view of Datta by using an article containing a film as taught by Barbee for the purpose monitoring an etching condition of a workpiece being etched which does not interfere with the impingement of an etchant upon a workpiece (Barbee, column 3, lines 17-21).

6. Claims 8, 11, 12, and 14 are rejected under 35 U.S.C. 103(a) as being unpatentable over Erk (US '437) in view of Datta (US '638).

Erk teaches a method comprising the steps of:

immersing a semiconductor into a tank of etchant (column 7, lines 13-17);

Erk also teaches, “. . . the wafers are etched . . . for a period of about 1 to 10 minutes . . . wafers are rotated while they are in contact with the flowing etchant . . . the wafers are rotated at a speed less than about 5 rpm” (column 4, lines 19-26). “As the etchant flows into the etch tank, . . . the drive mechanism . . . are rotated to cause the semiconductor wafers rotate . . .” (column 7, lines 17-24), which reads on,

rotating the semiconductor wafer while in the etchant for an amount of time; and

“The wafers are etched . . . for . . . 1 to 10 minutes . . . the flow of liquid continues . . . and the etch rack is removed from the etch tank . . . to remove any etchant which may remain on the surface of the wafers” (column 8, lines 30-42) and “. . . the wafers are rotated at a speed less than 5 rpm . . .” (column 4, lines 19-21), which reads on,

removing the semiconductor from the tank of etchant), as **in claim 8**;

rotating comprises continuously rotating the semiconductor wafer an amount of time, as **in claim 11**; and

rotating the semiconductor wafer at a speed of 1 to 5 revolutions per minute, as **in claim 12**.

Erk differs in failing to teach the semiconductor contains a film having a plurality of solder bump on an article and immersing the solder bumps into a tank of etchant, **in claim 8** and the film is a metallic film **in claim 14**.

Datta teaches, “After the solder bumps are formed, . . . The substrate now is covered with . . . solder bumps” (column 3, lines 10-12). “The etchant removes Ti-W . . .” It can be used with dip etching” (column 7, lines 41-44). The former reads on the article contains a film having a plurality of solder bump on the article and the latter reads

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on immersing the article containing the film having a plurality of solder bumps into a tank of etchant, as in **claim 8**. The above further reads on the film is a metallic film, as in **claim 14**. Datta illustrates that wafers with solder bumps are conventionally etched by dip etching.

It would have been obvious to one having ordinary skill in the art at the time of the claimed invention to employ any wafer, including a conventional wafer having solder bumps as disclosed by Datta in the process of Erk because Erk does not limit the specific types of wafers processed by the rotating etching process. It would appear that any wafer, including one with solder bumps, would benefit from the uniform etching process of Erk. Applicants have not shown anything unexpected by employing a conventional wafer with solder bumps in a known process for achieving uniform etching.

7. Claims 9 and 10 are rejected under 35 U.S.C. 103(a) as being unpatentable over Erk (US '437) in view of Datta (US '638) as applied to claim 8 above, and further in view of Takeshi (English translation of JP '977 A2).

Erk in view of Datta differs in failing to teach the step of rotating comprises sequentially rotating the semiconductor, in **claims 9 and 10**; and

sequentially rotating comprises rotating the semiconductor an amount but less than a complete rotating, and repeating the steps of rotating and etching for an amount of time, in **claim 10**.

It is well known in the art that a complete rotation is 360 degrees. Takeshi teaches the steps of etching a semiconductor by setting a fixed angular velocity so that

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the total angle of rotation becomes less than 360 degrees and etching for a fixed time [0025 and 0028], which reads on rotating the article an amount but less than a complete rotation. Takeshi also teaches repeating the step of rotating and etching for an amount of time [0030].

It would have been obvious to modify Erk in view of Datta by using Takeshi's step of sequentially rotating an article for the purpose of improving the method of detecting defects in semiconductor processing.

8. Claim 15 is rejected under 35 U.S.C. 103(a) as being unpatentable over Erk (US 437) in view of Datta (US '638) as applied to claim 8 above, and further in view of Barbee (US '705).

Erk in view of Datta differs in failing to teach the film is a non-metallic film.

Barbee teaches a workpiece **20**, such as a semiconductor wafer comprises one or more film layers on a surface thereof, the film layers are either patterned or unpatterned (column 5, lines 42-50; column 7, lines 67 - column 8, line 7) and " . . . the removal of a conducting or dielectric film from the etched work piece **20** . . ." (column 6, lines 63-64), which further reads on the semiconductor containing a film being non-metallic, as in the claimed invention.

It would have been obvious to one having ordinary skill in the art at the time of the claimed invention to modify Erk in view of Datta by using an article containing a film as taught by Barbee for the purpose monitoring an etching condition of a workpiece

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being etched which does not interfere with the impingement of an etchant upon a workpiece (Barbee, column 3, lines 17-21).

Response to Arguments

9. Applicants' arguments filed 5/23/2006 have been fully considered but they are not persuasive. Applicants traversed the 35 U. S. C. §103(a) rejection of claims 1, 4, 5, and 6 over Erk (US 5,340,437) in view of Datta et al. (US 5,462,638); claims 2-3 and 9-10 over Erk (S '437) in view of Datta (US '638) and further in view of Takeshi (JP 9115977 A2) and claims 7 and 15 over Erk (US '437) in view of Datta (US '638) and further in view of Barbee et al. (US 5,445,705); claims 8, 11, 12, and 14 over Erk in view of Barbee (US '705).

I. Applicants argue, Erk teaches etching a bare silicon wafer and fails to teach etching a film having a plurality of solder bumps, to be applied to any other process other than the removal of residual effects of sawing and lapping, to address uniformly etching a film across the entire wafer; and to teach improving the uniformity of etching of a film having a plurality of solder bumps. Applicants also argue Datta, which is directed to etching one of the TiW metallic films underlying the solder bumps by dip etching (column 3, lines 10-12 and column 7, lines 41-44), fails to cure Erk's deficiencies.

Applicants' arguments, Erk's deficiencies and Datta's failure to cure Erk's deficiencies are acknowledged. But Applicants' arguments are unpersuasive because Erk has provided a process in which wafers can be uniformly etched at relatively slow rotation speeds (column 2, lines 13-18) compared to etching wafer by rotation at

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relatively high speeds to minimize nonuniformity. Further, it has been shown that Erk teaches a method wherein an article is immersed in, rotated in and removed from a tank containing etchants (column 4, lines 19-26; column 7, lines 17-24; column 8, lines 30-32; and column 8, lines 38-42) while Datta has shown an article having a plurality of solder bumps. Hence, it would have been obvious to one having ordinary skill in the art at the time of the claimed invention to employ any wafer, including a conventional wafer having solder bumps as disclosed by Datta in the process of Erk because Erk does not limit the specific types of wafers processed by the rotating etching process. It would appear that any wafer, including one with solder bumps, would benefit from the uniform etching process of Erk.

In response to applicant's argument that there is no suggestion to combine the references, the examiner recognizes that obviousness can only be established by combining or modifying the teachings of the prior art to produce the claimed invention where there is some teaching, suggestion, or motivation to do so found either in the references themselves or in the knowledge generally available to one of ordinary skill in the art. See *In re Fine*, 837 F.2d 1071, 5 USPQ2d 1596 (Fed. Cir. 1988) and *In re Jones*, 958 F.2d 347, 21 USPQ2d 1941 (Fed. Cir. 1992). In this case, the reason for combining Erk and Datta is that since Erk does not limit the specific types of wafers processed by the rotating etching process, then it would appear that any wafer, including one with solder bumps as taught by Datta, would benefit from the uniform etching process of Erk.

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II. Applicants traverse the rejection of claims 2 and 3, and 7 over Erk in view of Datta and further in view of Takeshi et al. ((JP 9115977) and the rejection of claim 7 over Erk in view of Datta and further in view of Barbee et al. (US 5,445,705). Applicants argue Erk in view of Datta fails to teach the step of sequentially rotating the article in claims 2 and 3 and Takeshi is not directed to the improving the uniformity of a film having a plurality of solder bump and Takeshi is nonanalogous art and should be withdrawn as a reference.

It is acknowledged that Erk in view of Datta differs in failing to teach the step of rotating comprises sequentially rotating the article, in **claims 2 and 3**. However, Takeshi teaches repeating the step of rotating and etching for an amount of time [0030], which reads on sequentially rotating comprises rotating the article an amount. Hence, it would have been obvious to modify Erk in view of Datta by using Takeshi's step of sequentially rotating an article for the purpose of improving the method of detecting defects in semiconductor processing.

In response to applicant's argument that Takeshi is nonanalogous art and should be withdrawn as a reference is nonanalogous art, it has been held that a prior art reference must either be in the field of applicant's endeavor or, if not, then be reasonably pertinent to the particular problem with which the applicant was concerned, in order to be relied upon as a basis for rejection of the claimed invention. See *In re Oetiker*, 977 F.2d 1443, 24 USPQ2d 1443 (Fed. Cir. 1992). In this case, Takeshi is analogous art because it is directed to a method of etching a wafer, which is immersed

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and rotated in an etchant and removed while observing the wafer for defects (Abstract, [0017-0018]).

III. Applicants' traverse the rejection of claims 8, 11, 12, and 14 over Erk in view of Barbee for the same reason as recited above in claim 1. Applicants' arguments are acknowledged and the same rationale to show Applicants' arguments is unpersuasive in claim 1, above is also applicable to claim 8. It is noted that the Applicants assert no independent ground of patentability for claims 11, 12, and 14 at this time.

IV. Applicants' traverse the rejection of claims 9 and 10 over Erk in view of Datta and further in view of Takeshi and claim 15 over Erk in view of Datta and further in view of Barbee for the same reason as recited above in claim 8. Applicants' arguments are acknowledged and the same rationale to show Applicants' arguments is unpersuasive in claims 2, 3, and 8, above is also applicable to claims 9 and 10. It is noted that Applicants assert no independent ground of patentability for claim 15 at this time.

Conclusion

10. **THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any

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extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Lynette T. Umez-Eronini whose telephone number is 571-272-1470. The examiner is normally unavailable on the First Friday.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Nadine Norton can be reached on 571-272-1465. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

Art Unit 1765

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August 7, 2006

NADINE WORTON
SUPERVISORY PATENT EXAMINER
ART UNIT 1765
